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# Analysis of orbital theories for the construction of the numerical theory of the lunar physical librations

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## Abstract

© Published under licence by IOP Publishing Ltd. When using the numerical approach to construct the theory of physical libration of the Moon, it is necessary to solve the problem of comparing the numerical and analytical theories of lunar orbital motion. During these studies, the impact on the parameters of physical libration from the Moon's center of mass motion is determined. The paper contains the results of determining the effects caused by distinction in the position of lunar center of mass whose location is obtained according to two various lunar orbital theories. The analytical theory by Gutzwiller and Schmidt [1] constructed within the main problem of the Moon's motion and DE432 numerical theory taking into account a large number of factors, that extend beyond the main issue and that would be complicated or even impossible to consider when obtaining the analytical solution, are compared. Some reductions had been carried out in order to bring both theories to a unified reference system. Then the positions of the Moon's center of mass obtained in those theories were compared at an interval of 800 years. As a result, it was established that the amplitude of residual differences at the interval did not exceed 80 arc seconds in longitude and 10 arc seconds in latitude. The main reason for the obtained differences is neglecting planetary perturbations in the analytical theory. Other effects to distinguish the numerical theory from the analytical one are: motion of plane of the ecliptic, the Earth's and Moon's flattening, tidal effects etc. Those effects also cause the difference between the theories but slightly.

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